PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of: J. Carl Cooper

Serial No.: 16,923 Group No.: 254

Filed: February 20, 1987 Examiner: Richard Roseen

For: APPARATUS AND METHOD FOR CONTINUOUSLY SHIFTING PHASE OF AN ELECTRONIC SIGNAL

Commissioner of Patents and Trademarks
Washington, D.C. 20231

AMENDMENT TRANSMITTAL

1. Transmitted herewith is an amendment for this application.

STATUS

2. Applicant is
   - [X] a small entity — verified statement:
     - [ ] attached.
     - [X] already filed.
   - [ ] other than a small entity.

CERTIFICATE OF MAILING (37 CFR 1.8a)

I hereby certify that this paper (along with any referred to as being attached or enclosed) is being deposited with the United State Postal Sevice on the date shown below with sufficient postage as first class mail in an envelope addressed to the: Commissioner of Patents and Trademarks, Washington, D.C. 20231.

Geraldine Vannell
(Type or print name of person mailing paper)

Date: 2-11-88

Geraldine Vannell
(Signature of person mailing paper)

EXTENSION OF TERM

3. (complete (a) or (b) as applicable)

(a) Extension requested (*check below the total number of months of extension requested*):

	Extension (months)	Fee for other than small entity	Fee for small entity
☐	one month	$56.00	$28.00
☒	two months	$170.00	$85.00
☐	three months	$390.00	$195.00
☐	four months	$610.00	$305.00

Fee $85.00

(check and complete the next item, if applicable)

☐ An extension for ________ months has already been secured and the fee paid therefor of $________ is deducted from the total fee due for the total months of extension now requested.

Extension fee due with this request $________

or

(b) ☐ Applicant believes that no extension of term is required. However, this conditional petition is being made to provide for the possibility that applicant has inadvertently overlooked the need for a petition for extension of time.

FEE FOR CLAIMS

4. The fee for claims has been calculated as shown below:

	(Col. 1)		(Col. 2)	(Col. 3)	SMALL ENTITY			OTHER THAN A SMALL ENTITY	
	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NO PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE	ADDIT. FEE	*OR*	RATE	ADDIT. FEE
TOTAL	* 25	MINUS	** 20	= 5	x6=	$30		x12=	$
INDEP.	* 5	MINUS	*** 3	= 2	x17=	$34		x34=	$
☐ FIRST PRESENTATION OF MULTIPLE DEP. CLAIM					+55=	$		+110=	$
					TOTAL ADDIT. FEE	$ 64	*OR*	TOTAL ADDIT. FEE	$
						$ 64			

* If the entry in Col. 1 is less than entry in Col. 2, write "0" in Col. 3.
** If the "Highest No. Previusly Paid for" IN THIS SPACE is less than 20, enter "20".
*** If the "Highest No. Previously Paid For" IN THIS SPACE is less thant 3, enter "3".
The "Highest No. Previously Paid For" (Total or indep.) is the highest number found in the appropriate box in Col. 1 of a prior amendment or the number of claims originally filed.

(complete (c) or (d) as applicable)

(c) ☐ No additional fee is required

or

(d) ☒ Total additional fee required $64.00

11 + B1, Pg 4

080 03/03/88 16923 [redacted] 34.00 CK
080 03/03/88 [redacted] 1 203 30.00 CK
080 03/03/88 16923 1 216 85.00 CK

Figure 8 is a set of waveforms showing typical control voltages of Figure 7.

Clean Enter R.R.R. B

Figure 9 shows typical waveforms for the circuit of Fig. 4; and

Figure 10 shows typical waveforms for the circuit of Fig. 7.

a2 + a3 + B2, Pg 6

Page 5 Line 21 - after "Integrator 22." Insert:

a2

Control element 23 provides control signals Ma-Md for controlling multipliers 17a-17d in response to an input. The control signals are provided such that the multipliers cause the applied signal to be turned on and off in a particular sequence and manner which will become apparent from the disclosure herein.

Page 5 Line 22 - before "Referring" Insert:

a3

Figure 8 shows typical waveforms 20a thru 20d which would be produced by control element 23 of Figure 7, and particularly demonstrating the time relationship between the multiplier control voltages Ma thru Md versus time or versus rotation which are shown by way of example.

B2

Figure 9 shows typical waveforms for Fig. 4, including phase shifted signal waveforms 24a - 24d, wiper rotation graph 25 and output waveform 26.

P Figure 10 shows typical waveforms for Fig. 7 including: input waveform 27, phase shifted signal waveforms 28a - 28d, pulse input 29, control signal waveforms 20a - 20d, and output signal waveform 30.

Figure 9 shows typical waveforms for the circuit of Fig. 4. 24a-d shows four phases of an electronic signal in amplitude versus time plots. A graph of typical wiper rotation of the circular resistive means is shown in 25 and an amplitude versus time plot of the output from 11b, is shown at 26. Plots 24, 25 and 26 have the same time scale, and time points V, W, X, Y and Z have been identified by dashed lines. At time V the wiper is at the 0° position (not to be confused with the 24a 0° phase) which is chosen, for the purpose of explanation, to be located at 10d, therefore, the 270° signal is passed to 11b. At time W the wiper rotates CCW until time X, causing the 0° signal to be output.

At time Y, the wiper again rotates CCW providing a continuous phase shifted output signal until time Z. Note that the continuous phase shift to the output signal causes the frequency of the output signal to change. In the present example, the wiper rotated CCW, thus decreasing the frequency of the output signal. Had the wiper rotated CW instead of CCW, the frequency would have increased.

B4. Pg 12

Page 11, Line 7, after "used.", Insert: -- The multiplier devices would be configured to pass a portion of the applied phase shifted signal by, in effect, varying the impedance from the input to output terminal in response to a control element. In the use of multipliers, a portion may well be an amount greater than the input, due to the presence of a gain stage in conjunction with the multiplier. It will be apparent to one skilled in the art that the operation of the multiplier may or may not include a gain stage, and that the description and claim of portions or percentages of signals is intended to cover operation with or without such gain. --

B4

Page 14 and 15

generator circuits are well known in the art, and could be used for the ramp generating function. While shown specifically in an analog embodiment, it will be understood by one skilled in the art that digital implementations of any or all of the above described functions and means can be utilized. B6

Ins B6> B5>

Page 13, Line 5, after "utilized", Insert:

B6

Mechanical or electronic embodiments of the various functions can also be utilized, for example: the claimed portion means may be comprised of a mechanically resistive embodiment, such as that of Fig. 5, or of an electronic embodiment, such as the multipliers for Fig. 7. The control means or element can be mechanical, such as 11c of Fig. 5, or electronic, such as in Fig. 7. Other features and elements of the invention may also be implemented in either mechanical or electrical form, as will be apparent to one skilled in the art from the teachings herein.

B6 cont

14

Figure 10 shows typical waveforms which would be seen for the circuit of Fig. 7. The waveforms of Fig. 10 are also similar to those of Fig. 9, except that the wiper rotation waveform 25 has been replaced with input pulse 29 and Ma - Md (20a - 20d), the same as in Fig. 8. Figure 10 shows input waveform 27 which is input to phase shift means 6e, and outputs 28a - 28d corresponding to ØA - ØD. Output waveform 30 corresponds to the output from 21. It can be seen that the multipliers 17 and control element 23 essentially provide the same function as the circular resistive element and wiper shown in Fig. 4, thereby achieving the phase shift. The operation of Fig. 7 is essentially the same as that of Fig. 4, except that a given phase shifted signal (or portions of two phase shifted signals) is selected by a multiplier 17 in response to 23, whereas in the circuit of Fig. 4, the selection is provided by rotating the wiper. The phase of waveform 30 corresponds to ØD between time V and time W. At time W, Md decreases and Ma increases, and the phase of 30 is the vector sum of ØA and ØD. At time X, 30 has the same phase as ØA. For the time period from Y to Z, the output 30 has a frequency shift. While signals Ma - Md have been shown as triangular in shape, other shapes will also work. It has been found that a half sinusoid shape works well in terms of minimizing distortion on the output signal. There is no requirement that a complete transition from minimum to maximum be made within any given time and these signals may as well be caused to make only a partial change and then stop.

Claims 4, 14, 17

B9

[redacted] 13 [redacted] The improved selectable phase shifter of Claim 1 characterized by the addition of another input coupled to an even further phase shifted input signal and said portion means coupled to said another input coupled to an even further phase shifted input signal with said portion means operable such that said device may output a portion of [and the resistance extending between and coupling to] said further phase shifted input signal and a portion of said even further phase shifted input signal so as to allow for an even further range of available phase shift.

B8

[redacted] 14 [redacted] The improved selectable phase shifter of Claim [1] 13 characterized in that said even further phase shifted input signal is derived directly from the input signal without substantial phase shift.